Water Quality Protection Report

Keyrock Energy, LLC
Jones Treatment Facility
NPDES PA 0219339
Black Lick Township, Indiana County

April 9, 2013

Prepared by:

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Project Description: ☐ New ☒ Existing/Renewal ☐ Amendment ☐ Transfer

A.   NPDES Application/Permit No.   **PA0219339**

Part II Permit No.   **3202021**

B.   Applicant: **Keyrock Energy, LLC**   Municipality: **Black Lick**

Facility: **Jones Treatment Facility**   County: **Indiana County**

C.   Type of Waste(s):   ☒ Industrial   ☐ Sewage   ☐ Storm water   ☒ Mine / Oil & Gas Extraction

D.   Facility Classification: ☐ Major   ☒ Minor   E.   U.S.G.S. Quad(s):   **Blairsville, PA**

F.   SIC Code(s):   **1311**   G.   NAICS Code(s):   **21 Subsector 211**

Water Uses and Criteria:

A.   Receiving Water: **Blacklick Creek**   Stream Code: **43979**   Reach Code: **05010007000138**

Drainage Area: **409.8** mi^2,   Yield: **0.049** cfs/mi^2,   Flow: **24.01** ft^3/s (Q_{7-10} low-flow)

Based on data from: **USGS Gage #03043000 Blacklick Creek at Blacklick, PA and USGS Streamstats (streamstats.usgs.gov)**

Elevation: **994**   ft,   Slope: **0.00012**   ft/ft,   Existing / Designated Use: **TSF**

Aquatic Life Use Attainment Status: ☐ Attaining   ☒ Non-attaining   ☐ Unassessed/Undetermined

Stream Listing Date: **2005**   Impairment Causes: **Abandoned Mine Drainage**

Expected TMDL Date: **January 2010**   Impairment Sources: **Metals**

Exceptions to standard uses: None   Exceptions to specific criteria: None

Add: Add:

Delete: Delete:

Impoundment: Special uses:

B.   Secondary Water: **Conemaugh River**   Stream Code: **43832**   Reach Code: **05010007000004**

Drainage Area: mi^2,   Yield: cfs/mi^2,   Flow: ft^3/s (Q_{7-10} low-flow)

Based on data from:

Elevation: ft,   Slope: ft/ft,   Existing / Designated Use:

Aquatic Life Use Attainment Status: ☐ Attaining   ☐ Non-attaining   ☐ Unassessed/Undetermined

Stream Listing Date: **N/A**   Impairment Causes:

Expected TMDL Date: **N/A**   Impairment Sources:

Exceptions to standard uses: Exceptions to specific criteria: None

Add: Add:

Delete: Delete:

Impoundment: Special uses:

C.   Downstream PWS location: **Buffalo Township Municipal Authority Freeport**   RMI: **29.4**

Stream name: **Allegheny River**   Distance from discharge: **46.5**   Miles

Stream flow at intake: _____ ft^3/s,   Intake: **1.25**   Mgd

Outfalls:

Outfall **001**   Lat. **40° 27′ 59.61″**   Long. **79° 17′ 21.12″**   RMI: **2.23**   Stream **Blacklick Creek**

Average Discharge Flow Rate: **0.04**   MGD   Based on data from: **Module 3 of NPDES Permit Application**

Treatment System Description: **Sedimentation basins for passive aeration, oxidation and settling.**

Discharge Sources and Characteristics: **Coal bed methane extraction production water.**

I

Technology Limit

- Section 304(b) of the Federal Clean Water Act (CWA) requires technology limits to be considered.

- Section 301(b)(2)(C) of the CWA requires compliance with best available technology (BAT) by March 31, 1989

- Sections 304(b)(2)(B), 304(b)(4)(B), and 402(a)(1) of the CWA allow for the establishment of effluent limits on a case-by-case basis (Best Professional Judgment or BPJ).

- 40 CFR 125.3(d) requires that six factors be considered in developing effluent limits based on BPJ. For BAT, they are: 1) the age of the equipment and facility, 2) the process employed, 3) the engineering aspects of the application of various types of control techniques, 4) process changes, 5) the cost of achieving such effluent reduction and, 6) non-water quality environmental impact (including energy requirements).

- PA Code Chapter 95.10 gives effluent standards for total dissolved soilds.

- The Oil & Gas Wastewater Permitting Manual gives technology based effluent limits for oil and gas well operations discharging water from an "off-site" treatment facility.

Jones Treatment Facility ("Jones") is an existing treatment facility for the treatment of water generated by dewatering coal seams from which methane gas will be extracted. This is also known as coal bed methane extraction. Many wells produce water from this activity in a given area and that water is conveyed via a pipe to a treatment facility. This is not a centralized waste treatment facility as defined by 40 CFR 437 because, "wastewater from the treatment of wastes received from off-site via conduit (e.g., pipelines, channels, ditches, trenches, etc.) from the facility that generates the wastes unless the resulting wastewaters are commingled with other wastewaters subject to this provision" are not subject to the CWT effluent limit guideline as described in the applicability section of 40 CFR 437. Water from coal bed methane production with similar characteristics is merely conveyed to treatment facility.

40 CFR 435 prohibits discharge of oil and gas production fluids from wells to surface waters of the commonwealth unless the wastewaters are removed to an "off-site" treatment facility. Off-site is defined as a central wastewater collection and treatment facility associated with a multiple well operation. Therefore, the production wastewater from individual coal bed methane wells to a central wastewater treatment facility. Only coal bed methane production wastewater is accepted; it is not comingled with any other wastes. The production water is subject to the provisions in the oil & gas wastewater permitting manual (OGPM).

The OGPM stipulates technology based effluent limitations as least as stringent as the following:

Parameter	Minimum	Average Monthly	Instantaneous Maximum
Total Suspended Solids (mg/L)	-	30	60
Oil and Grease (mg/L)	-	15	30
Iron, Total (mg/L)	-	3.5	7.0
Acidity (mg/L)	-	Less than Alkalinity.	
pH (STU)	6	-	9

Table 1: Technology based effluent limitations from the Oil & Gas Wastewater Permitting Manual

Additionally, the OGPM stipulates that the treatment facilities must incorporate the following:
- Flow equalization to ensure optimum treatment efficiency of the facilities and minimization of water quality impacts.
- Gravity separation and surface skimming, or equivalent technology, for oil and grease removal.
- Chemical addition for pH control and metals removal, if necessary (a pH range of 8.0-8.5 is desirable).
- Aeration, or equivalent technology, for reducing volatile petroleum hydrocarbons and oxidation for metals removal.
- Settling (retention) or filtration for removal of solids, including oxidized metals.

This facility is also subject to the effluent standard for Total Dissolved Solids (TDS) set forth in PA Code Chapter 95.10. This facility is not considered a new or expanding mass load as it was an authorized discharge prior to August 21, 2010. In the previous permit application the average and maximum discharge flows were reported in Module 3 of the permit application to be 0.04 and 0.6 MGD, respectively. Likewise, the average and maximum concentration of TDS were reported on module 4 of the permit application. Using this data an average and maximum TDS loading can be calculated, please see attached calculations. This is the authorized loading. It will be included as a special condition in the permit. If Jones

discharges over this loading it will be considered an expanding load and must be reevaluated under Chapter 95.10. The average and maximum loadings are shown below.

Parameter	Average Monthly	Maximum Daily
Total Dissolved Solids (lb/day)	1,731	29,524

Table 2: TDS effluent standards based on Chapter 95.10.

II

Water Quality Limit

- Section 302(a) of the Federal Clean Water Act (CWA) allows establishment of water quality limits.

- Section 303(a)(1) of the CWA allows States to adopt water quality standards.

- Section 303(d) of the CWA requires States to designate water uses (Chapter 93 of the Department's Rules and Regulations).

- Section 303(c) of the CWA requires States to develop water quality criteria (Chapters 16 and 93).

- Wasteload allocations stipulated in the Kiskiminetas-Conemaugh River Watersheds TMDL.

- PENTOXSD version 2.0c for Windows® is a single discharge, mass-balance water quality modeling program that includes consideration for mixing, first-order decay and other factors to determine recommended water quality-based effluent limitations for toxic substances and several non-toxic substances.

Outfall 001 discharges are evaluated for water quality impacts using PENTOXSD version 2.0c. Parameters selected for analysis include those given technology-based effluent limitations in Section I and any other parameters that were reported in the sample included in Appendix B of the permit application entitled October 13, 2008 Connate Water Sampling Program and Analytical Results. The sample taken out the outlet of pond 2 after the water has been treated was used for the analysis. The parameters analyzed were total iron, dissolved iron, aluminum and barium. No water quality based effluent limitations are needed based on this analysis. Additionally, mass balance calculations were performed for osmotic pressure and the necessary effluent limitation is shown in table 3, below.

Finally the discharge from this operation is subject to the Kiskiminetas-Conemaugh River TMDL, finalized January 29, 2010. Outfalls 001 existed at the time the TMDL was created and received wasteload allocations therein. Additionally, monitoring requirements for dissolved iron and chloride will be included as these are parameters of concern. The applicable water quality based effluent limitations are shown in table 3, below.

Pollutant	Monthly Average	Daily Maximum
Iron (mg/L)	1.5	2.94
Aluminum (mg/L)	0.48	0.75
Manganese (mg/L)	0.64	1.0
Chloride (mg/L)	Report	Report
Dissolved Iron (mg/L)	Report	Report
Osmotic Pressure (mOs/kg)	204	319

Table 3: Water quality based effluent limitations from mass balance calculations and Kiskiminetas-Conemaugh River TMDL.

III

Storm Water

The Department's policy for storm water discharges is to either (1) require that the storm water be uncontaminated, (2) impose "monitor and report," establish effluent goals and require the permittee to submit a Storm Water Pollution Prevention Plan (SWPPP), or (3) impose effluent limits. In all cases a storm water special condition is placed in the permit. Scottdale does not have any outdoor industrial activity. As described by Module 14 of the permit application they are eligible for no exposure certification for discharges of storm water associated with industrial activities.

IV

Effluent Limitations and Monitoring Requirement

- Section 301(b)(1)(C) of the Federal Clean Water Act (CWA) allows for the establishment of effluent limits that are more stringent than technology-based limits.

- 40 CFR 125.62 requires States to establish a monitoring program (i.e., sample type, monitoring frequency).

- Previous limits can be used pursuant to EPA's anti-backsliding regulation, 40 CFR 122.44(l).

- Sampling frequencies are based on Chapter 7 of the NPDES Permit Writer's Manual.

- The requirement to monitor flow is from 25 Pa. Code Chapter 92.41(c)(1).

- Technology limits in Section I are compared to the water quality limits in Section II. The more stringent of the two will be imposed.

Conclusions and Recommendations

Both technology and water quality effluent limits will be applied. Flow will be restricted to the design flow reported in the permit application. A monitoring requirement for chloride will be included due to anti-backsliding. Flow should be measured daily. Grab samples can be collected twice per month for total suspended solids, oil & grease, iron (dissolved), acidity, alkalinity, osmotic pressure, total dissolved solids and chloride. Once per week flow weighted composite samples should be collected for iron, aluminum and manganese. The final limits are shown in table 4 below.

| Parameter | Limit Basis | | | | | |
Industrial Wastewater	(Tech/WQ)	Monthly Avg.	Daily Max	Monthly Avg.	Daily Max.	Inst. Max.
Flow (MGD)	Technology	Report	0.6			
Total Suspended Solids (mg/L)	Technology			30		60
Oil and Grease (mg/L)	Technology			15		30
Iron, Total (mg/L)	Water Quality			1.5	2.94	
Manganese (mg/L)	Water Quality			0.64	1.0	
Aluminum (mg/L)	Water Quality			0.48	0.75	
Iron, Dissolved (mg/L)	Water Quality			Report		
Osmotic Pressure (mOs/kg)	Water Quality			204	319	
Alkalinity (mg/L)	Technology			Greater than acidity.		
Acidity (mg/L)	Technology			Report		
Total Dissolved Solids (mg/L)	Technology	Report		Report		
Chloride (mg/L)	Water Quality	Report		Report		
pH (STU)	Technology			Within a range of 6.0 to 9.0.		

Table 4. Effluent limitations for Outfall 001.

Effluent limitations rationale:
1. Guidelines/References: NPDES Permit Writer's Manual, Oil & Gas Wastewater Permitting Manual
2. Regulations: 25 Pa. Code Chapter(s) 16, 92, 93, and 95
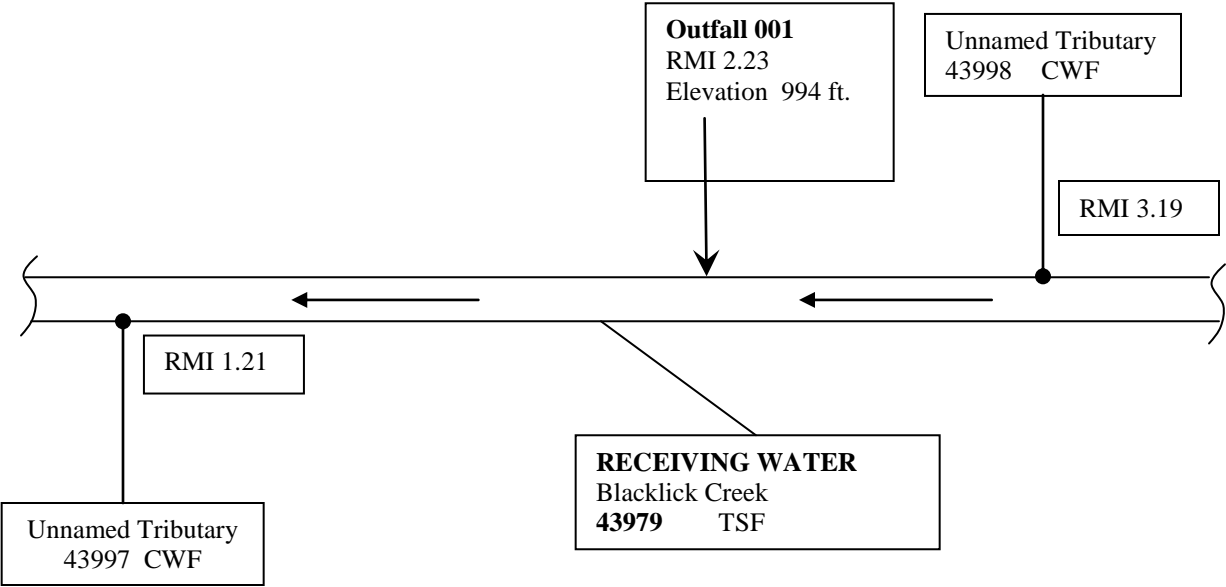3. Water quality computer models: PENTOXSD for Windows v2.0c

Approvals:

Reviewer: Permits/WQ _____ Date _____

Chief: Permits/WQ_____Date _____

V

References

Stick Diagram for Jones Treatment Facility

Outfall 001
RMI 2.23
Elevation 994 ft.

Unnamed Tributary
43998   CWF

RMI 3.19

RMI 1.21

RECEIVING WATER
Blacklick Creek
43979   TSF

Unnamed Tributary
43997 CWF

PENTOXSD

Modeling Input Data

Stream Code	RMI	Elevation (ft)	Drainage Area (sq mi)	Slope	PWS With (mgd)	Apply FC
43979	2.23	994.00	409.80	0.00012	0.00	☑

Stream Data

	LFY (cfsm)	Trib Flow (cfs)	Stream Flow (cfs)	WD Ratio	Rch Width (ft)	Rch Depth (ft)	Rch Velocity (fps)	Rch Trav Time (days)	Tributary Hard (mg/L)	pH	Stream Hard (mg/L)	pH	Analysis Hard (mg/L)	pH
Q7-10	0.049	0	0	0	0	0	0	0	100	7	0	0	0	0
Qh		0	0	0	0	0	0	0	100	7	0	0	0	0

Discharge Data

Name	Permit Number	Existing Disc Flow (mgd)	Permitted Disc Flow (mgd)	Design Disc Flow (mgd)	Reserve Factor	AFC PMF	CFC PMF	THH PMF	CRL PMF	Disc Hard (mg/L)	Disc pH
Keyrock Jones	PA0219339	0.04	0.6	0.6	0	0.25	0.25	0.25	0.25	100	7

Parameter Data

Parameter Name	Disc Conc (µg/L)	Trib Conc (µg/L)	Disc Daily CV	Disc Hourly CV	Steam Conc (µg/L)	Stream CV	Fate Coef	FOS	Crit Mod	Max Disc Conc (µg/L)
ALUMINUM	333	0	0.5	0.5	0	0	0	0	1	0
BARIUM	3380	0	0.5	0.5	0	0	0	0	1	0
DISSOLVED IRON	46	0	0.5	0.5	0	0	0	0	1	0
TOTAL IRON	125	0	0.5	0.5	0	0	0	0	1	0

Stream Code	RMI	Elevation (ft)	Drainage Area (sq mi)	Slope	PWS With (mgd)		Apply FC
43979	1.12	992.00	415.00	0.00012	0.00		☑

Stream Data

	LFY (cfsm)	Trib Flow (cfs)	Stream Flow (cfs)	WD Ratio	Rch Width (ft)	Rch Depth (ft)	Rch Velocity (fps)	Rch Trav Time (days)	Tributary Hard (mg/L)	pH	Stream Hard (mg/L)	pH	Analysis Hard (mg/L)	pH
Q7-10	0.049	0	0	0	0	0	0	0	100	7	0	0	0	0
Qh		0	0	0	0	0	0	0	100	7	0	0	0	0

Discharge Data

Name	Permit Number	Existing Disc Flow (mgd)	Permitted Disc Flow (mgd)	Design Disc Flow (mgd)	Reserve Factor	AFC PMF	CFC PMF	THH PMF	CRL PMF	Disc Hard (mg/L)	Disc pH
		0	0	0	0	0	0	0	0	100	7

Parameter Data

Parameter Name	Disc Conc (µg/L)	Trib Conc (µg/L)	Disc Daily CV	Disc Hourly CV	Steam Conc (µg/L)	Stream CV	Fate Coef	FOS	Crit Mod	Max Disc Conc (µg/L)
ALUMINUM	0	0	0.5	0.5	0	0	0	0	1	0
BARIUM	0	0	0.5	0.5	0	0	0	0	1	0
DISSOLVED IRON	0	0	0.5	0.5	0	0	0	0	1	0
TOTAL IRON	0	0	0.5	0.5	0	0	0	0	1	0

PENTOXSD Analysis Results

Hydrodynamics

SWP Basin	Stream Code:	Stream Name:
18D	43979	BLACKLICK CREEK

RMI	Stream Flow (cfs)	PWS With (cfs)	Net Stream Flow (cfs)	Disc Analysis Flow (cfs)	Reach Slope	Depth (ft)	Width (ft)	WD Ratio	Velocity (fps)	Reach Trav Time (days)	CMT (min)
Q7-10 Hydrodynamics											
2.230	20.0802	0	20.0802	0.9282	0.00012	1.01367	91.7802	90.5425	0.22581	0.3004	943.497
1.120	20.335	0	20.335	NA	0	0	0	0	0	0	NA
Qh Hydrodynamics											
2.230	102.237	0	102.237	0.9282	0.00012	2.04173	91.7802	44.9522	0.55054	0.12321	1000+
1.120	103.37	0	103.37	NA	0	0	0	0	0	0	NA

PENTOXSD Analysis Results

Wasteload Allocations

RMI	Name	Permit Number
2.23	Keyrock Jones	PA0219339

AFC

Q7-10:   CCT (min)   15   PMF   0.25   Analysis pH   7   Analysis Hardness   100

Parameter	Stream Conc (µg/L)	Stream CV	Trib Conc (µg/L)	Fate Coef	WQC (µg/L)	WQ Obj (µg/L)	WLA (µg/L)
TOTAL IRON	0	0	0	0	NA	NA	NA
DISSOLVED IRON	0	0	0	0	NA	NA	NA
ALUMINUM	0	0	0	0	750	750	4806.277
BARIUM	0	0	0	0	21000	21000	134575.8

CFC

Q7-10:   CCT (min)   720   PMF   1   Analysis pH   7   Analysis Hardness   100

Parameter	Stream Conc. (µg/L)	Stream CV	Trib Conc. (µg/L)	Fate Coef	WQC (µg/L)	WQ Obj (µg/L)	WLA (µg/L)
TOTAL IRON	0	0	0	0	1500	1500	33950.22
WQC = 30 day average. PMF = 1.							
DISSOLVED IRON	0	0	0	0	NA	NA	NA
ALUMINUM	0	0	0	0	NA	NA	NA
BARIUM	0	0	0	0	4100	4100	26274.32

THH

Q7-10:   CCT (min)   720   PMF   0.25   Analysis pH   NA   Analysis Hardness   NA

Parameter	Stream Conc (µg/L)	Stream CV	Trib Conc (µg/L)	Fate Coef	WQC (µg/L)	WQ Obj (µg/L)	WLA (µg/L)
TOTAL IRON	0	0	0	0	NA	NA	NA
DISSOLVED IRON	0	0	0	0	300	300	1922.511
ALUMINUM	0	0	0	0	NA	NA	NA
BARIUM	0	0	0	0	2400	2400	15380.09

CRL

Qh: CCT (min)   720   PMF   0.25

PENTOXSD Analysis Results

Wasteload Allocations

RMI	Name	Permit Number
2.23	Keyrock Jones	PA0219339

Parameter	Stream Conc (μg/L)	Stream CV	Trib Conc (μg/L)	Fate Coef	WQC (μg/L)	WQ Obj (μg/L)	WLA (μg/L)
TOTAL IRON	0	0	0	0	NA	NA	NA
DISSOLVED IRON	0	0	0	0	NA	NA	NA
ALUMINUM	0	0	0	0	NA	NA	NA
BARIUM	0	0	0	0	NA	NA	NA

PENTOXSD Analysis Results

Wasteload Allocations

RMI	Name	Permit Number
2.23	Keyrock Jones	PA0219339

PENTOXSD Analysis Results

Recommended Effluent Limitations

SWP Basin	Stream Code:		Stream Name:
18D	43979		BLACKLICK CREEK

RMI	Name	Permit Number	Disc Flow (mgd)
2.23	Keyrock Jones	PA0219339	0.6000

Parameter	Effluent Limit (µg/L)	Governing Criterion	Max. Daily Limit (µg/L)	Most Stringent WQBEL (µg/L)	WQBEL Criterion
ALUMINUM	333	INPUT	519.534	3080.63	AFC
BARIUM	3380	INPUT	5273.343	15380.09	THH
DISSOLVED IRON	46	INPUT	71.767	1922.511	THH
TOTAL IRON	125	INPUT	195.02	33950.22	CFC

	Flow (mgd)	TDS Concentration (mg/L)	TDS Loading (lb/day)
Average	0.04	5187.31	1,731
Maximum	0.6	5900	29,524

FLOW (mgd) x CONCENTRATION (mg/L) x 8.34 = LOADING (lb/day)
0.54 x 4153 x 8.34 = 33,327

Osmotic Pressure Effluent Limit Calculation

Variable	Definition	Variable	Value	Source
Q_{7-10}	7 day low flow with a recurance frequency of 10 years.	Q_{7-10}	19 ft³/s	USGS Gage #03083100 Jacobs Creek at Jacobs Creek, PA
LFY	Low Flow Yield	DA_g	390 mi²	USGS Gage #03083100 Jacobs Creek at Jacobs Creek, PA
DA_g	Drainage area at the USGS gage.	DA_d	409.8 mi²	USGS Streamstats (streamstats.usgs.gov)
DA_d	Drainage area at the point of discharge.	PMF	0.25	BPJ
Q_s	Stream Flow	Q_d	0.9283 ft³/s	Permit application.
Q_s'	Stream Flow at Point of Compliance.	X_{us}	0 mOs/kg	Unknown, assumed 0.
PMF	Partial Mix Factor	X_{ds}	50 mOs/kg	Pa. Code Chapter 93.7
Q_d	Discharge Flow	X_a	13,800 mOs/kg	Permit application.
X_{us}	Upstream Concentration			
X_{ds}	Downstream Concentration			
X_a	Discharge Concentration in Permit Application			
X_d	Daily Maximum Effluent Limitation.			

To calculate daily maximum:

$LFY = Q_{7-10}/DA_g$

$LFY = 19 \text{ ft}^3/s / 390 \text{ mi}^2$

$\quad LFY = 0.049 \text{ ft}^3/s / \text{mi}^2$

$Q_s = LFY * DA_d$

$Q_s = 0.049 \text{ ft}^3/s / \text{mi}^2 * 410 \text{ mi}^2$

$\quad Q_s = 19.96 \text{ ft}^3/s$

$Q_s' = Q_s * PMF$

$Q_s' = 19.96 \text{ ft3/s} * 0.25$

$\quad Q_s' = 4.991 \text{ ft}^3/s$

$(Q_s' + Q_d) * X_{ds} = X_d * Q_d + X_d * Q_s'$

$(4.991 \text{ ft}^3/s + 0.928 \text{ ft}^3/s) * 50 \text{ mOs/kg} = X_{d \, mOs/kg} * 0.928 \text{ ft}^3/s + 4.991 \text{ ft}^3/s * 0 \text{ mOs/kg}$

$\quad X_d = 318.8 \text{ mOs/kg}$

To calculate monthly average: Formulas taken from table 5-3 in the Technical Support Document for Water Quality Based Toxics Control (TSD). The percentage exceedance probability is the 99th percentile as designated in Pa Code Chapter 96. A sample size of 4 was used to represent weekly sampling.

$$\frac{\text{Maximum Daily Limit}}{\text{Average Monthly Limit}} = 1.56$$

$$\frac{109.6 \text{ mOs/kg}}{AML} = 1.56$$

$$AML = 204.4 \text{ mOs/kg}$$